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Chronic Nontuberculous Infections of the Lungs.

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There is in law and justice a principle which emphasizes that however bad the previous record of a criminal may have been this must not be considered in arriving at the facts of the crime for which he is on trial. All the crimes are not committed by the criminals we have caught.

This is the situation in chronic infections of the lungs. We must guard against the tendency to blame the bacillus of tuberculosis for all the illnesses which suggest, by this or that symptom or sign, its presence. Tuberculosis is very common and we have had some measure of success in lessening its mortality, if not its morbidity, rate in recent years and for this reason we should not handicap our statistics by including in them nontuberculosis conditions. Further, great efforts should be made to discover when other germs are more important than even the tubercle bacillus, i.e., when the patient's recovery is prevented by these other microorganisms.

The positive diagnosis of pulmonary tuberculosis depends upon finding B. tuberculosis in the sputum or from the lung itself. This is usually a fairly direct procedure but in cases which are open to doubt certain precautions are necessary. The particular precaution to which I would call your attention is that of preventing oily substances such as petrolatum or iodized oil (Lipiodol) from coming in contact with the material to be examined. I have shown that these substances are able to make non-acid-fast bacteria appear acid-fast and where bacteria resembling B. tuberculosis in morphology such as the diphtheroids are present in lung cavities or in the pleural fluid confusion might result. Two instances of this technical chance of error have come to my attention. One was a case of empyema with a resection of a rib. A granulomatus growth had developed at the site of operation and a section from a piece of this tissue suggested a tuberculous process. A smear from the pus showed a variety of bacteria including diphtheroids, and there was found in the acid-fast stain a group of red staining bacteria resembling B. tuberculosis but somewhat atypical in shape. Irrigation of the cavity had been done and petrolatum (vaseline) had been rubbed on the edges of the opening to prevent cutaneous irritation. It was this petrolatum which, coming in contact with the bacteria, gave the false acid-fast stain. B. tuberculosis could not be demonstrated and animals injected with the pus did not develop tuberculosis. Xylol applied to the experimental smear before staining removed this thin coating of petrolatum from about the bacteria.

The other instance was once reported in the literature of the finding of "tubercle bacilli" in a lung cavity after the use of Lipiodol although none could be demonstrated previously. Lipiodol acts like the petrolatum in changing the character of bacteria. Chloroform or carbon tetrachloride removes the film

of oil in this instance while xylol has little effect.

The important conclusions from these findings are that animal inoculation and culture remain the best methods for finally determining the presence of B. tuberculosis.

It is indeed essential when we make the diagnosis of tuberculosis that our evidence is free from any possible error.

There are two divisions to my paper, in both of which information about the nontuberculous infection may be most helpful in making as complete as possible the diagnosis of a patient's condition.

(1) The first is that in which tuberculosis is present, but a following or accompanying infection with some other microorganism has been overlooked, or if recognized has been underestimated.

(2) The second division includes other infections which give rise to chronic changes stimulating tuberculosis in the symptoms or in the clinical findings. Here will be found a number of those conditions which account for the 10 per cent. of cases wrongly diagnosed tuberculosis. These sharp outlines cannot be fully maintained but will serve, nevertheless, as fulcrums to emphasize certain points.

In the first division where B. tuberculosis is present we have to consider how great the influence of other infections may be on the course of the disease or the health of the patient. Here I enter a field of controversy. Acute infectious diseases are generally recognized as potent factors in lighting into activity a latent or low grade tuberculosis. Pneumoccus lobar pneumonia, hemolytic streptoccoccus bronchopneumonia, after whooping cough, measles and similar diseases are among the important antecedent events to the onset of clinical tuberculosis in many patients. There is some difference of opinion about influenza. Most investigators believe that the associated pneumonia acts like the conditions I have just mentioned. Others go so far as to suggest that influenza may promote cure in certain cases by means of the induced fibrosis. All agree that tuberculous patients are not immune to influenza but, if they are clinical cases under treatment, the disease is often mild because the patients are on the defensive and the influenza does not get as much headway as it does in otherwise healthy persons. In later stages the effect of influenza may often be very severe.

In the more advanced cases of pulmonary tuberculosis with cavitation there are to be considered the frequent secondary infections which occur in the lung cavities directly communicating with the upper respiratory tract. Here again we have a variety of opinions. Some holding that the mixed infection has no effect, others that these infections are the causes of the lesions and the worst symptoms of the disease, while a third group consider the tubercle bacilli alone responsible for both the lesions and the important symptoms, but that the secondary germs account for many of the minor effects. It is difficult for me to believe that tuberculous cavities filled with bacteria, many of which can be shown to be pathogenic, do not act as foci of infection in much the same way as teeth, tonsils, sinuses and other infected regions. Patients with tuberculosis are not immune from the effects of other infections and the absorption of toxic products, and every physician realizes the necessity of taking particular precautions against many of these infections. In certain of these cases blood cultures have been positive for pneumococcus or streptococcus and it has been thought these germs had entered the blood stream from the pulmonary cavities. The bacteria found in these cavities are commonly pneumococci (Type IV), Streptococcus hemolyticus, Streptococcus viridans, Micrococcus tetragenous, various diphtheroids, sometimes B. influenzae and many others. On one occasion I drew from the lung at an autopsy of a case of ad-

vanced tuberculosis with cavitation, a pure culture of B. influenzae and saw in smears also B. tuberculosis. The reaction in the lung gave evidence, by the type of oedema, of the combined effect of the B. influenzae and B. tuberculosis and many similar multiple reactions are undoubtedly often encountered. Moulds and certain yeast forms may also be found in such cavities as secondary invaders, but as a rule of not very much significance. In the cases I have seen the mould was noted in the lung tissuue as mycelium with little or no reaction about it. The whole character of the sputum, may, however, be changed in the presence of an infection by the Fusospirochetes or other anaerobic bacteria. This type of infection is discussed more fully below, but it may be noted that the character of the disease process in such cavities favors the implantation of these anaerobes. Certain investigators have reported that on occasion the associated bacteria may actually bring about the disappearance of the tubercle bacilli from the sputum. This whole subject is full of unsolved problems concerning beneficial or antagonistic synergism or symbiosis, the solution of which may be helpful. There is further the question concerning the use of autogenous vaccines in certain cases, but this is still in the experimental stage.

2. The second division of my paper is more difficult. The list is long of infections which have been wrongly diagnosed tuberculosis or in which the diagnosis has been difficult.

Some forms of bronchitis with hemoptysis and chronic cough are caused by certain infections such as mould, monilia, spirochetes or the bronchoanaeromycosis of Castellani. Purulent bronchitis often shows B. influenzae as the infecting bacterium, and this organism accounts for certain cases of pulmonary fibrosis. Pulmonary fibrosis also follows pneumonia of Pneumococcus origin, and in many of the bronchopneumonias with streptococci interstitial pneumonia is the final result. Pulmonary fibrosis of syphilitic origin (rarely diagnosed) should however be thought of and a number of fungus infections are at times responsible.

Bronchiectasis, the end result of many of these postpneumonic chronic lung conditions with fibroid changes, bronchial dilation and chronic bronchitis, is not always easy to differentiate. The microorganisms found are most varied. B. influenzae is found in some. In fact, to the supporters of the view that B. influenzae is the bacterial causative agent in influenza such bronchiectatic cavities are considered the reservoirs for the infection during interepidemic times. Stapylococcus aurcus is, however, frequent, and hemolytic streptococci and pneumococci are often found. A number of these cases are of spirochetal origin and a few are infected with moulds. Lung abscess is often easier to diagnose, but in healing it may leave a cavity which, rarely, might lead to difficulty. The persistent productive cough is the most characteristic symptom of lung abscess, and the same types of bacteria are found as in bronchiectasis. Acute experimental lung abscess, healing before 30 days, has been produced in dogs by emboli infected with staphylococcus. These abscesses have been rendered chronic by a following insufflation with bronchiectatic sputum 10 days after the primary infection.

Gangrenous processes may occur as simple or multiple abscesses, gangrenous pneumonia or diffuse gangrene. The important micro-organisms responsible for these conditions are the spirochetes and the anerobe B. fusiformis, with streptococci as contributing agents. The place of origin of these germs is the oral cavity from about the teeth and in the tonsils and prevention consists in treating these sites of infection. The same infection may complicate unresolved pneumonia and bronchiectasis and account for certain cases of putrid bronchitis. The characteristic finding is foul smelling sputum teeming with spirochetes, fusi-

form bacilli and streptococci. Anti-syphilitic treatment is often effective in these lung gangrene cases so that the diagnosis of syphilis has not infrequently been wrongly made. The problem of syphilis of the lung as gumma (a comparatively rare event), as causing pulmonary fibrosis and as associated with and complicating tuberculosis need only be mentioned to be appreciated. Its frequent association with tuberculosis and the beneficial effect of its active treatment on the latter should, however, be more fully recognized, and tuberculosis patients with an associated history of syphilis or a positive Wassermann should be particularly studied for this complication.

Pulmonary mycosis (Pneumonomycosis) may be primary or secondary to other infections. Recent workers think it not uncommon as a primary infection whose importance we simply do not know because so little attention has been paid to it. Moulds belonging to the common groups, Mucor, Penicillium and Aspergillus, have been found and more rarely other types. Aspergillus is by far the most common. Moulds were found in the lungs as early as 1842, and Virchow reported four cases in 1856 and the number of cases has been increasing as more careful diagnosis are being made. They may be most confusing. Frequent profuse hemoptysis in a patient in rather good general condition is considered one of its characteristics. The favorable reports on the use of potassium iodide make the diagnosis particularly desirable. A report from France claims that the tuberculin test is positive in Aspergillus infections in the lung.

Infections with yeast forms, monilia and others are not infrequently reported. Such forms are often found in the oral cavity and direct smears are of great value in determining the value of sputum cultures. Blastomyces gives lesions in the lungs practically identical, as Miller has recently shown, to those of tuberculosis, and one wonders how often the diagnosis may have been wrong because not expected. An analagous close resemblance between blastomycotic and tuberculous meningitis we have noted in our laboratories.

Actinomyces is not by any means a rare lung infection in certain regions, the lung being the third most common site for its primary localization and its chronic course has led to its confusion with tuberculosis. The acid-fast form as it appears in the sputum adds to the confusion and guinea pigs injected with these organisms give, according to certain workers, positive tuberculin tests, binding of complement with tubercle bacillus antigen and vice versa.

I do not suppose the occasional infection of the lung with Entamoeba histolytica or the worm Distoma pulmonalis has often caused trouble. Interesting reports of pulmonary involvement in the course of infection by B. melitensis-abortus in which a number of cases were diagnosed tuberculosis, bears out my opening suggestion that the general practitioner is inclined to diagnose as tuberculosis all kinds of pulmonary conditions, if the etiology is confusing or not suspected, on the basis that the chances are, statistically, that he will be right.

With an appreciation of the various conditions favoring bacterial or other infections in the various stages of many of these lung processes which have become chronic, much can be done towards prevention and in many cases great benefit can be obtained by special treatments.

I am afraid I may have over-emphasized the chronic lung conditions which have a nontuberculous etiology as if they were necessarily independent of tuberculosis when as a matter of fact they very often complicate each other, and the difficult task of the clinician is to weigh the evidence and to determine the relative significance of each. I believe a restudy of the whole problem of primary and secondary infections in chronic lung diseases is needed and par-

ticularly the low grade types of infection where the germs are causing chronic irritation and not an active healing or destructive reaction in the invaded tissues.

Tuberculosis will remain the main interest, but much help can be obtained by these supplementary studies so that we may know more exactly how big the problem actually is.

Physiology of the Thyroid.

By FRED. HARVIE, B.A., 3T0.

Fashions in dress add interest to the social world, and likewise fashions in thought sway even the careful scientist. For physiologists, the pH phenomena long held the centre of interest, and still earlier, the ductless glands afforded them an easy explanation for almost anything. Endocrinology invaded the laboratories and drug houses like an epidemic, and the layman still uses its mysterious drugs with magic powers. But out of this era has emerged a sound conception of endocrine physiology, and, especially in the case of the thyroid, the main principles are now probably well established.

The thyroid is apparently not essential for life, but is necessary for proper development of the young and for adult health. The more apparent relations of thyroid deficiency to cretinism, adult myxedema and simple goitre are common knowledge and need not be discussed. Simple goiter, and in fact all thyroid disturbances, are endemic in this section of Ontario, and Marine observes an interesting correspondence between the endemic areas of North America and the soil areas deposited by the last glacial period. Thyroid troubles form a major clinical problem the world over, being always, however, more prominent in non-maritime regions.

The anatomy, histology and embryology are readily accessible from any text book. One point of interest here, however, is the arrangement of the mitochondria or granules in the alveolar cells which according to Bensley, suggests an ability to secrete either to the lumen or towards the basement membrane and blood stream.

Of immediate interest are the physiological hyperplasias of the thyroid, for herein lies the key to its physiology. It "is a very labile tissue capable of marked and rapid hyperplasia and involution in response to variations in functional activity." (Marine). During hyperplasia the colloid disappears, the cells become columnar and the alveoli enlarge. Marine believes that the thyroid has essentially only one anatomic cycle, which he depicts as follows:

(1) Normal Thyroid—Hypertrophy—Hyperplasia: Atrophy.
Colloid or Resting Stage.
and this may pass into (2) below—

(2) Colloid Thyroid—Hypertrophy—Hyperplasia: Atrophy.
Colloid or Resting Stage.

The periods of special activity are four in number—foetal life, puberty, pregnancy and lactation, and the menopause, all periods of hyperactivity for the whole organism, and it is at such times that thyroid disorders appear. Acute infections are also often accompanied by enlargement of the gland. Frequently, each succeeding pregnancy leaves the gland somewhat larger. Further, if a large part of the gland is removed from a normal animal, an active hyperplasia takes place, identical with that normally found in production of simple goiter. The colloid disappears,

the alveolor cells multiply and change to an actively secreting columnar type.

As early as 1616, Paracelsus suggested a relation between adult goiter and cretinism, but thyroid physiology began in 1874 with Gull's publication, "On a Cretinoid State Supervening in Adults." For some years still, however, the gland was hopelessly confused with the parathyroids and progress was delayed.

Murray, in 1891, cured a case of myxedema by administration of a glycerol extract of sheep's thyroid. It is found that such an extract will completely replace the gland in thyroidectomized animals. Such animals, untreated, give birth to goiterous offspring, but if the mother is given extract during pregnancy the young are born with normal thyroids.

The next step came with the introduction of the iodine factor. A century ago Prevost associated endemic goiter with a deficiency of iodine in the soil and water of goiterous districts and the discovery by Baumann in 1895 of a firm organic iodine compound in the colloid material, directed special attention to this feature. He called his product iodothyrine. Finally, in 1914, Kendall announced the isolation of a halogen crystalline compound containing 65% iodine, and displaying all the physiological activity of the gland extract.

The significance of iodine has been worked out by Marine and his co-workers. During the resting stage the gland contains 1-5 mgm. of iodine per gm. of dried gland, and this represents practically all the iodine in the body. With active hyperplasia the colloid disappears, and the iodine content falls rapidly to almost zero. Further, if iodine is fed during the hyperplastic stage, there is immediate involution to the resting stage, with reaccummulation of colloid and iodine, and the condition of colloid goiter supervenes. In vitro or from perfusion fluids, even the resting thyroid shows a remarkable affinity and capacity for storing iodine. Here it is interesting to note that, though simple adenomata of the gland appear during hyperplasia and show this same iodine affinity, carcinomata of the thyroid epithelium contain no iodine and have no affinity for it. Iodine feeding will prevent hyperplasia in a dog from which up to three-quarters of the gland has been removed, and alternate litters of goiterous and normal puppies can be obtained by feeding or withholding iodine from such mothers. In Cleveland, where practically all dogs have some thyroid hyperplasia, normal thyroids are assured by prenatal iodine therapy. By carefully controlled experiments with goiterous and partially thyroidectomised animals, as well as by analysis of human goiterous glands, Marine and Lenhart found that hyperplasia begins when and only when the iodine content of the gland drops below 0.1 per cent.

Thyroid transplants are readily made to other parts of the body and they respond exactly as the main gland to periods of hyperplasia and to iodine treatment; apparently nervous secrettory control is a very small factor.

From the facts presented, it would seem that we are able to completely control all the physiological activities of the gland by administration of iodine when part of the gland is left, or by the iodine containing hormone when it has been removed. The function of the thyroid would seem to be that of picking up iodine from the blood stream and formulating the hormone, which is stored as colloid in the alveoli.

But what is this hormone, and what is the mechanism of its profound effect?

Magnus Levy in 1895, reported that in adult myxedema, the respiratory exchange, or basal metabolic rate, was much reduced, while in exophthalmic goiter, it was very high. The removal of all or part of the gland also lowers the rate 30-40 per cent. below normal—the same rate is found in eretinism—where it is maintained. Feeding of thy-

roxin will raise the rate and keep it up, while dispelling all symptoms. In each of the periods of special thyroid activity noted above, the basal metabolic rate is raised. Further, feeding of thyroxin to normal animals gives all the symptoms of hyperthyroidism, viz., rapid pulse, tremor, emaciation, and increased basal metabolism; but no amount of thyroxin feeding ever produces the additional signs of exophthalmic goiter, i.e., the typical eye signs. Apparently another undetermined factor is concerned here, probably outside the glands. Thyroxin or iodine added to water in which tadpoles are living, produces a loss in weight with early and rapid metamorphosis.

The remaining problem is obviously the study of thyroxin itself. Kendall calls his product trihydro-triiodo-oxy beta indoleproprionic acid, which would be related to tryptophane.

He believes it to belong to that important group of substances, of which the best known is the glutathione, called hydrogen acceptors. They are readily reducible substances which are believed to affix the hydrogen from a molecule of water, leaving nascent oxygen free for tissue oxidation They are readily re-oxidised from the blood stream and thus can be used over and over again. Thyroxin is said to break between the NH and CO groups of the pyrrole ring, with addition of two hydrogen atoms. Furthermore, a reduced form of thyroxin has been isolated from the tissues. Thus "expressed in chemical terms, the function of thyroxin is to regulate the capacity of the cells to use oxygen." (Boothyby and Sandford), and hence its intimate control of metabolism.

Crile observed an increased nerve conductivity in the presence of thyroxin and believes its action to be one of accelerating nervous activity, but his theory shows little promise and has not been confirmed or accepted.

The confirmation of Kendall's structural formula awaits synthesis of thyroxin. Harington and Barger have recently synthesized a substance which they claim to be thyroxin containing two benzene rings. Physiologically, it has given some encouraging results, but has not yet been accepted by everyone.

Diet certainly plays a rôle in production of simple goiter. Thyroxin is said to be more effective if fed with amino acids, while high protein and fat diets definitely predispose to goiter formation. Sea foods of all kinds are preventive on account of the iodine contained. Iodine can be absorbed from the bowel, through the skin or even by inhalation of sea spray, so maritime peoples are practically free of thyroid disorders.

This modern view of the thyroid has already permittted wide clinical application. Marine has definitely established the advisability of prophylactic iodine therapy during pregnancy, and for school children in endemic areas, especially with a family history of goiter; also a limited effect on developed simple goiter, under 25 years of age. Its indiscriminate use above this age is not without danger and should be used only as a short pre-operative treatment for exophthalmic goiter. The danger is that of stirring to activity a latent exophthalmic disturbance.

Further investigation of any of the ductless glands must proceed towards a clearer understanding of the intimate interrelations which certainly exist between all members of the group — a study of endocrinology as a whole.

In closing, Dr. Marine has admirably summed up the whole thyroid situation as follows: "Broadly defined, our present conception of the function of the thyroid is that it provides the means through its iodine-containing hormone, of maintaining a higher level of metabolism than could otherwise obtain, and also through fluctuation in its activity it provides a means for varying the rate of metabolism to meet changing physiological needs."

Systolic Murmurs.

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Laennec introduced auscultation about 1800, and in 1819, when he first published his description of murmurs, he thought that a murumr indicated either stenosis or regurgitation, and that the situation of the murmur obviously indicated which valves were affected. On seeking confirmation of his views, by autopsy findings, he became so confused that he concluded that murmurs had no diagnostic value or use whatever. This was the commencement of an enormous amount of investigation and speculation with reference to the cause of certain murmurs, especially systolic ones. Although much information has been gained in the succeeding century, much uncertainty still exists. It is still a common occurrence to be unable to state definitely the cause of a certain type of murmur. Fortunately, so much other information can be found out in connection with the structure and function of the heart that we can afford to disregard certain murmurs.

In general, one includes in the meaning of the word "murmur," sounds which are produced outside the heart, including noises produced in the overlaying edge of lung. Most of these murmurs are due to the blood flowing through a channel of unequal diameter, entering into vibration whenever it passes from a relatively narrow, to a broader part. Other factors which affect the production of a murmur are the rate and direction of the flow, the character of the wall and the viscosity and tension of the blood. These factors, however, have more to do with the character of the murmur than its actual production. In general, other things being equal, the smaller the opening, the louder and rougher the murmur; and the greater the rate of flow, the louder the murmur. These general considerations obviously apply to intra-cardiac murmurs only.

Extra-Cardiac Murmurs.

Two other sources of murmurs must be considered, viz., the so-called cardio-respiratory or cardio-pulmonary murmurs. This is one of the most frequently encountered varieties. This murmur is supposed to be produced by a sudden inrush of air into the lung which overlies the heart, to fill up the space created by the contracting ventricles. They are usually systolic, although they may be both systolic and diastolic. A suddenly relaxing heart may compress the overlaying edge of lung and force the air out of it at a rapid enough rate to produce an audible sound. These murmurs may therefore be heard in every cardiac area. They are necessarily more or less confined to the edges of the lung. One recognizes a cardio-respiratory murmur partly by its character, it being a superficial whiff most commonly heard only during inspiration, but chiefly by the fact that one can cause it to disappear by some respiratory mechanism—that is, it may be absent during inspiration or during expiration or during the time of holding the breath at the end of a deep inspiration, or at the end of deep expiration. The diastolic part often only occupies the first part of diastole. It occurs must commonly in hearts that are enlarged or hearts that are contracting rapidly. It is therefore very frequent in hyperthyroidism. A cardio-respiratory murmur has no significance with reference to the diagnosis or prognosis.

The other adventitious sound which might be confused with an intra-cardiac murmur is a pericardial friction. This noise is superficial, is increased by the pressure of the stethescope, is usually

"to and fro," and the timing does not correspond exactly with systole and diastole. The two elements of the friction seem to overlap the sounds, that is, the diastolic part may run into systole, and the systolic part may overlap the second sound Pericardial frictions are usually temporary, lasting only a few hours or a few days. Murmurs are much more likely to be permanent. Friction sounds are most often heard about the middle and upper part of the heart where the pericardium is reflected. They are not transmitted, and may change with the position of the patient.

When a fibrinous pleurisy exists in front of or near the pericardium, the movements of the heart in systole and diastole may produce a friction which is cardiac in time, even although respiratory movements may not produce the friction. This is common in pneumonia, and causes considerable difficulty in the differential diagnosis between pleurisy and pericarditis, because pericarditis is fairly common also in pneumonia. This so-called pleuro-pericardial friction is necessarily limited to the site of the body on which the pleurisy occurs, unless, by chance there be a pleural friction on both sides. If one can elicit a pleural friction by a deep breath, and there be no accompanying cardiac symptoms or signs, such as increased rate, etc., the noise should be considered a pleuro-pericardial friction. If, however, it overlaps the middle line, it is likely to be a true pericardial friction.

Intra-Cardiac Murmurs—Pulmonary Systolic.

Of the intra-cardiac murmurs, the most common ones are the pulmonary systolic. These murmurs are usually soft but they may be quite harsh, and are heard over the second, third and fourth left intercostal spaces. There are two theories to explain their presence, apart from the existence of actual valvular disease The explanation which best fits most of them is that the murmurs produced by the blood flowing through the pulmonary orifice into the pulmonary artery, which has a wider diameter than the orifice, especially on expiration. The fact on which this theory is based is that the murmur is present when the diaphragm is high and is absent when the diaphragm is low. In watching the heart under the X-ray fluroscope, during expiration one sees the great vessels at the base widened, and during inspiration the diaphragm descends, pulling down with it the heart and elongating and narrowing the great vessels at the base. If, therefore, the pulmonary systolic murmur disappears on deep inspiration, or on standing up and taking a deep inspiration, one considers it to be due to a normal dilation of the pulmonary artery. This murmur is therefore usually only audible when the patient is lying down. It has no diagnostic or prognostic significance.

Some systolic murmurs are transmitted to this area from the mitral area, because one is listening over the left auricle and a mitral systolic murmur, when it is not very loud, will not be transmitted to the left axilla, but will be heard also in the pulmonary area. The miximum intensity of a murmur produced by dilation of the pulmonary artery is in the pulmonary area. This point should serve to distinguish the two.

Occasionally, a pulmonary systolic murmur may be due to actual valvular disease, which is usually congenital, but at times, acquired. When such is the case, the murmur is constant, and likely to be accompanied by a thrill. In congenital pulmonary stenosis there are also other points to assist in the diagnosis, such as a history of the condition having existed from birth, with or without cyanosis, and clubbing of the fingers.

Congenital patency of the ductus arteriosus may produce a murmur in this area which, on superficial examination could be considered systolic. Careful auscultation, however, will show

that the murmur runs without a break through systole well into diastole, with a mid-systolic exacerbation.

Apical Systolic Murmurs.

On hearing a systolic murmur in the mitral area, the first point to ascertain is whether it be cardio-respiratory or not. Next, a friction must be excluded. Having decided that the murmur is produced at the mitral orifice, the next point to consider is whether the murmur be due to endocardial damage or dilation of the ring. The points which help one to decide this question might be tabulated as follows: the murmur is probably due to valve damage if (a) it be loud and rough and transmitted to the left axilla (b) the first sound be altered or absent, that is, replaced by a murmur, (c) it be accompanied by a thrill (in fact, mitral stenosis is usually present in addition, if there be a mitral systolic thrill), (d) the heart be enlarged, (e) the patient have signs and symptoms of a persistent infection, such as a fever lasting for weeks or months when all other causes for fever excepting endocarditis have been excluded by careful investigation. Even although the murmur may disappear when the patient stands up, it may still be due to valvular defect. The fact that it disappears when standing merely proves that it is unimportant, or due to a slight defect. If the murmur be increased by exercise, it is suggestive that it is due to endocardial damage.

Life insurance companies will issue policies to applicants who have a mitral systolic murmur without enlargement, although they rate them up a few years, that is, they charge them an increased premium, because the mortality is about two hundred per cent. in this group. Having concluded that a mitral systolic murmur is due to valve defect, this, in itself is of little importance. The points that are of importance are whether the muscle be damaged or not, and whether the disease be healed or progressive. The murmur gives you no information with reference to these two important points.

Aortic Systolic Murmurs.

An aortic systolic murmur may be best heard on either the right or the left side of the sternum, although usually the right side, in the second interspace. The point which determines its aortic origin is whether or not the murmur is transmitted up the vessels of the neck and out towards the shoulder. It is also transmitted to the apical area. An aortic systolic murmur differs slightly from a mitral systolic murmur, in that it increases in intensity earlier in systole and then diminishes, whereas a mitral systolic murmur tends to diminish from its commencement. One can diagnose nothing from an aortic systolic murmur alone. An aortic systolic murmur may be caused by (a) vegetations or scarring on the edge of the valve or sclerotic thickening at the base of the cusps, (b) dilation of the aorta, (c) roughening of the wall of the aorta or aneurysm, (d) actual stenosis.

If the patient be a child with evidences of a persistent infection, then an aortic systolic murmur is probably due to vegeations or scarring of the edge of the valve. This murmur is soft or slightly rough, but not rumbling. It is best heard lying down, and may disappear entirely when the patient stands up. If the patient be an elderly individual an aortic systolic murmur is suggestive of sclerosis at the base of the valve, and intimates that one should think of sclerosis of the wall of the aorta and coronaries. Dilatation of the aorta should be excluded. One looks for a pulsation in the second right interspace, and the episternal notch. A pulsation in either of these areas may be discovered or confirmed by palpation. The width of the arch should be percussed. If the aortic second sound be of the ringing or "bottle" character, the aorta is dilated. If an aortic diastolic murmur be present and is louder on the right side of the sternum than on the left, then the heart is shifted to the right, or the aorta is dilated. Where possible, a teleradiograph or an ortho-

diagram should be made. Screening the patient assists in the diagnosis of a dilated aorta or aneurysm, because, by turning the patient, one can see through the posterior mediastinum. The pressure signs and symptoms of an aneurysm or a greatly dilated aorta also assist in the diagnosis. In aortic stenosis, the murmur is loud and rumbling, and usually is accompanied by a systolic thrill, either in the aortic or over the vessels in the neck. The left ventricle is enlarged. In advanced cases, the pulse may be altered to the so-called "plateau" type, that is the rise of the pulse wave is small and slow, the wave is well maintained, and the fall is slow. In still more advanced cases, the blood pressure gives evidence of a small, slow output from the left ventricle, in the form of a small pulse pressure. One can, however, detect the pulse of aorta stenosis earlier, with the finger than with the blood pressure apparatus.

Tricuspid Systolic Murmurs.

The tricuspid valve ring is much more easily dilated than the mitral, and endocarditis of the tricuspid valve is much more uncommon. Therefore, systolic murmurs in this area are nearly always due to dilation of the ring. The importance of the case cannot be estimated by the presence or absence of the murmur. The murmur may be present when the function of the heart is normal or there may be failure with passive congestion. Tricuspid insufficiency is sometimes very marked, so that the veins in the neck show a greatly increased systolic pulsation, and, in time, become much dilated. In a serious tricuspid insufficiency, pulsation is often felt in the liver. In rheumatic fever, a tricuspid endocarditis may actually occur. It would, however, be practically impossible, except in cases of marked regurgitation, to distinguish between a tricuspid systolic murmur due to endocardial damage and one due to dilation of the ring.

In discussing the cause of systolic murmurs, one dislikes the words "organic" and "functional." The laity consider organic disease serious, and functional disease of no importance. The reverse may be true. A tricuspid systolic murmur might indicate a dilating and failing ventricle, and a loud, rough, mitral systolic murmur, due to a healed valve defect, might be present throughout life, in a heart which is functionally perfectly normal.

Haemic Murmurs.

Any of the above murmurs might be present in a severe anaemia, and the explanation is the same as has already been given. It is doubtful if a murmur can be produced from altered viscosity of the blood alone. In practice, one sees cases with a haemaglobin of twenty per cent. showing no murmur whatever. It is, of course, true that murmurs are more readily produced in the less viscous blood of anaemia than under normal conditions, but the fact remains, that they may be best explained by previously mentioned causes.

Factors in Vomiting of Pregnancy.

By PROFESSOR VICTOR JOHN HARDING,
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This article is in the nature of a review. Nausea and vomiting of pregnancy has been the subject of a number of theories, most of which have been premature, some of which have been singularly inept, and only a few of which have fulfilled the purpose of a theory, i.e., the stimulation of further experimental work. In the present state of our knowledge it is impossible to define the primary etiological factor. Various changes in metabolism have been suggested, notably among which has been the so-called "carbohydrate" deficiency" theory, because it has led to a certain standardization of treatment in various centres, and consequently has led to a collection of data by various observers under similar circumstances, and notable because it has acted as a stimulus to further research work. Changes in endocrine balance have been suggested, in turn the thyroid, the pituitary, the suprarenals, the corpus luteum have been proposed as the primary etiological cause Protein intoxication, intestinal intoxication, protein split products and infection have received their share of the blame.

The general classification of vomiting of pregnancy at present held by obstetricians is "neurotic" and "toxic." This represents the old classification of Williams with one omission. Williams classified vomiting of pregnancy into "reflex, neurotic, and toxic." The first is left out now-a-days. From time to time, however, some test or other will be described in the literature, to distinguish between the "neurotic" and "toxic" types of case. This presupposes, if not two distinct origins of vomiting of pregnancy, at least that the disturbance will run exclusively on one or the other of the mentioned courses. This is not the writer's view. The vomiting, once initiated, and there may be more than one immediate origin, will continue, with results, and consequent symptoms, varying in different individuals. The speed with which dehydration takes place, the mental reaction of the patient to the discomfort and feeling of nausea, the course taken by the dehydration, and whether or not it selects one or other particular organ upon which to produce further changes, all form factors, the variation, and interplay of which, make up the symptom complex as seen in the individual. In the writer's opinion the value of such tests as have been described, to distinguish "neurotic" from "toxic" vomiting, is to determine if this or that particular organ, whose function is under investigation, has or has not undergone a certain amount of degeneration or destruction. If degeneration or destruction is found, the course of the vomiting and its sequelae has proceeded to a stage when its effects are demonstrable in physical tests. "Toxic" vomiting represents a certain stage in the course of the disorder. The relationship of the stage of "toxic vimiting" to the onset of the disorder is not necessarily a constant one. The "toxic" stage may be reached much more rapidly in some patients than others, in some so rapidly indeed, that there is no time to observe any other. Such a case would be labelled as "toxic vomiting" from the very onset. A slower rate of development of the disorder, giving opportunity for compensatory changes to set in and restorative measures to be applied, without effecting a complete cure, could be classified as "neurotic." A change in any of the conditions, leading to an increased rate of development of the disorder, is liable to change a "neurotic" to a "toxic" vomiting. Biochemical investigation of vomiting of pregnancy has shown that in general

three factors can be discerned from a study of the urine and blood. A fourth factor is "neurosis" as yet not susceptible to biochemical analysis but comprising a mass of mental reactions to stimuli the sum total of which produces an unfavorable impression on the observer. The three factors are starvation, dehydration, and disturbance of hepatic function.

Starvation: With the cessation or diminution in food intake certain sequelae inevitably follow. The urine and blood will contain "acetone." There are often surprisingly large amounts of these bodies in the urine. The writer has observed as much as eighteen grams of oxybutyric acid a day. The Rothera and the Gerhardt test give strong reactions. The finding of positive reactions thus is not a matter of surprise. Occasionally, however, the examination of the urine, of a case reported as vomiting of pregnancy, will yield negative results with these tests. Such a case must necessarily have only a slight degree of vomiting, and despite the probable statement, backed up by the affidavit of her husband, that "she has eaten nothing at all for the last week," has nevertheless retained a considerable portion of food. Such a case would certainly be classed as "neurotic." There is only a small amount of "acetone" in the blood, and unlike the ketosis of diabetes, it has never in our experience resulted in such a lowering of the CO_2 combining power of plasma, that the patient becomes in danger of passing into coma through this case. It is therefore unnecessary to administer sodium bicarbonate. Other observers have, however, occasionally reported such low CO_2 combining powers of plasma that "acidosis" might be considered as impending, and advise the use of sodium bicarbonate. As a normal physiological consequence of the ketonuria, and in accordance with well-known laws of acid-base equilibrium, ammonia will be found in the urine in increased amounts. The increase will be dependent upon the extent of the ketonuria, and this in general, under conditions of starvation, will reflect the extent of the total metabolism. Consequently an excitable patient, with some epigastric pain, and moving restlessly in bed, will excrete a larger amount of "acetone" than a patient, much more seriously ill, and lying in a semi-stuporous condition. The amount of ammonia in the first case will be greater than in the second. Yet the amount of urinary ammonia, or the ammonia coefficient $\frac{\text{gm. } NH_3}{\text{gm. N}} \times 100$) has been proposed as a distinction between "neurotic" and "toxic" vomiting of pregnancy. Underhill and Rand went to great pains, some fourteen years ago, to stress the physiological nature of the increased urinary ammonia in starvation, and to point out the fallacies involved in the interpretation which some obstetricians had placed upon it. Yet, the same fallacious interpretation is still to be found in some text-books

Dehydration: With the loss of fluid by vomiting and a lessened intake of water generally brought about by the patient's fear of producing further vomiting by drinking, dehydration is bound to occur. One evident effect is on the urine. It becomes low in volume and highly coloured. It may, or may not be, high in specific gravity. This depends upon the stage of the dehydration and the speed with which it is produced. A rapid acute dehydration produces a high specific gravity urine, followed by one of moderate specific gravity. A dehydration produced more slowly will show a urine of moderate specific gravity. It was one of the early observations that a successfully-treated case of vomiting of pregnancy always showed a urine of continually increasing volume, and continually decreasing specific gravity This ultimately led to the rule being formulated that fluids should be given these patients by all routes as rapidly as possible until the urine was at least one litre in volume and of a specific gravity

of 1010 or less. This still remains, after seven years' experience, a good sound rule. It is evidence that the effects of the dehydration have been overcome, as far as is possible, by the simple administration of fluids. The estimation of the serum proteins also offers valuable evidence on the state of dehydration. The general average value for serum proteins in vomiting of pregnancy is raised. In individual cases it may be quite high. Yet such a case may not seem seriously sick and may respond rapidly to treatment, and recover within forty-eight hours. Such a case usually possesses a history of vomiting of short duration. It represents the acute stage of dehydration. There may be present no signs of dehydration in the patient beyond a little thirst and perhaps a slight dryness of the skin. The blood volume will be found to be reduced, but on the administration of fluids the original volume will be restored. One is dealing with a blood, econcentrated by loss of some of its water, and it is an easy matter at this stage to restore it to its original condition. In general, the finding of an increased value for the serum proteins in vomiting of pregnancy is a good prognostic sign. Conversely, the finding of values for serum proteins lower than normal is a sign of grave prognosis. Here all the classical signs of dehydration may be present,—cyanosis, low blood pressure, weak, thready pulse, dry, pale mucous membranes—all making a picture of shock. Not only is the blood volume low, but its form elements and colloid material have undergone partial destruction, so that the simple administration of fluids is unable to restore the blood to its original condition. The administration of fluids may bring about some improvement, but complete recovery will not be attained until the full regeneration of blood volume has taken place. In extreme cases blood transfusion is necessary.

Dehydration does not proceed with the same speed or in the same direction in all individuals. The writer has seen two successive periods of acute dehydration occur within seven days in one patient, and this despite the patient's efforts to overcome them by the drinking of fluid The production of a lowered CO_2 combining power due to ketosis has already been described, but occasionally the loss of fluid and gastric contents has been so acute that an actual alkalosis may be impending, just as if the case were one of doudenal obstruction. In a woman, with a previous history of nephritis, the writer has seen the kidney function rendered so poor that the blood picture became that of uremia. Whether the failure of hepatic function which is often seen in vomiting of pragnancy is an independent phenomenon, or not, it is at present unable to be stated with certainty, but without doubt the dehydration intensifies the process. Dehydration, in one or other of its stages, is the most important clinical factor. It must be overcome before progress can be made in any other direction.

Failure of Hepatic Function: Eighty per cent. of all cases of vomiting of pregnancy show urobilinuria. It is not possible at present to state that the remaining twenty per cent. should be classified as vomiting of pregnancy of origin differing from the rest. It may be that the urobilinuria represents a phase of the disorder developing with the dehydration. Urobilinuria seems to mean fealure of hepatic function to deal with the normal production of that pigment by the intestine, when the phenomenon is observed in early cases of vomiting of pregnancy. It seems impossible to account for its presence in the urine, as a result of increased blood destruction, though this may act as an enhancing factor in more severe cases. Recent work on the use of phenoltetrachlorophthalein as a liver function test, has shown that some cases of vomiting of pregnancy show a delayed excretion of that dyestuff and hence an impaired liver function. Such cases are classed as "toxic" in contradistinction to those behaving normally to the dyestuff, which are classed as "neuro-

tic." Urobilinuria without jaundice, without an increased direct Van den Bergh reaction, and with only a slightly increased indirect Van den Bergh, is an earlier sign of hepatic failure. Usually as the dehydration is overcome by the use of fluids, and as hunger returns, the taking of food by mouth acts as a sufficient safeguard against any further extension of liver damage. The urobilinuria rapidly disappears, or is reduced to a minimal amount. In a few patients, however, though the acute dehydration has been overcome, clinical improvement does not follow rapidly There is no hunger and a slight degree of vomiting is continuously present. Urobilinuria remains as a constant finding. Such cases, showing evidently, continuation of liver damage are treated with larger amounts of carbohydrate and protein in order to assist hepatic regeneration A duodenal tube is used, and a feeding, of three ounces of skim milk and three ounces of ten per cent. glucose, is given every two hours, night and day. This treatment has proved successful.

In conclusion, the four factors of starvation, dehydration, hepatic dysfunction and neurosis demand in treatment:

(a) Rest in bed with isolation in hospital, if possible.
(b) The use of bromides, chloral, or even morphine.
(c) Intravenous ten per cent. glucose, in saline, generally 2000 cc. daily until the urine becomes increased to at least one litre.
(d) The use of larger amounts of carbohydrate and protein by doudenal tube, in occasional cases.

(a) and (b) are designed to overcome the neurosis, (c) the dehydration and (d) a persistent hepatic dysfunction.

The Motor Cells of the Spinal Cord.

By C. HELEN CRAW, 3T0.

The picture of the spinal cord cut in cross-section is very familiar, and the gray butterfly or "H" against the white background is too characteristic to be forgotten. We lose a lot, however, by thinking of any organ entirely "on the flat" and the mental picture of the constituent parts of the spinal cord in three dimensions is more accurate and more useful. It is then obvious that the Anterior Horns of gray matter are more correctly spoken of as the anterior or ventral columns. This column relieved of the considerable layer of white matter which surrounds it on three sides and disconnected from the gray matter on its dorsal aspect is an irregularly fluted pillar extending throughout the whole length of the cord. It is not uniform in diameter but is bulged out chiefly in a lateral direction, in two regions, viz., in the lower cervical, and from the lumbar region to the caudal end of the cord.

Each ventral gray column is made up of nerve cells in a supporting network of neuroglia, and of non-myelinated fibres. The cells are motor in function and supply the voluntary muscles of the body. They are large—five to fifteen times the size of a red blood cell. Their length, i.e., their diameter parallel to the long axis of the cord, is about twice their horizontal diameter. This cell is usually studied as the typical nerve cell and its appearance is familiar—many processes, large centrally placed nucleus with conspicuous nucleolus and Nissl or chromophilic granules.

Let me remind you of the very characteristic appearance of the Nissl granules. They are coarse, irregularly cuboid and stain deeply with basic dyes.

They are more or less evenly distributed in rows, which arrangement is characteristic of cells with motor function and gives the cell the name "stichochrome." There are no Nissl bodies in the nucleus nor in the clear area from which the axone arises. They extend into the dendrites, appearing here as long, thin rods. The arrangement of these bodies throughout the cell body is important, as any change in it or in the staining properties of the granules in a well-fixed specimen signifies a pathological disturbance of the cell.

Another set of structures within the nerve cell is the neurofibrils. They are not seen when the cell is stained by ordinary methods. They are fine threads running from the dendritic processes to the axone. The nerve impulse travels in the same direction and these fibrils are thought to be the specific conducting elements. Apathy, who was the first to discover the neurofibrils, believed that they presented a means of direct communication from cell to cell. He described the central nervous system as an uninterrupted syncytium. His view is, of course, contrary to the neurone theory and has not been given popular support.

In the thorocic region, each ventral column contains about 1,500 motor cells for every spinal nerve, and the bulging of the cervical and lumbo-sacral regions is due to a great increase in the number of cells. It is of fundamental importance to realize that these cells do not increase in number during growth and are never replaced after destruction. They increase in size during growth, particularly in their longitudinal diameter.

Almost every author has his own method of grouping these cells as seen in cross-sections, the number of groups ranging from two to seven. There is also a bewildering variety of names for these groups. The important point is that a mesial group extends all down the cord supplying the axial musculature, and a large lateral group, containing many subgroups, forms the lateral prominence in each enlargement and its cells supply the muscles of the extremities. By the extirpation of limb muscles and the study of the effect on the motor nerve cells, the position of cells supplying individual muscles has been determined. Recent work tends to show that cells supplying functional muscle groups, e.g., muscles which act wholly or mainly as extensors of the arm, are grouped together in the cord.

Owing to the regular arrangement of the thirty-one pairs of spinal nerves, it has been customary to consider the spinal cord as a segmental organ. The segmentation, if present, should be evident in the longitudinal distribution of the cells, and it should be most easily recognized in the thoracic region, because the picture here is not complicated by the cells of the lateral group. However, even in this region, it is impossible to establish the beaded arrangement often described. The ventral column is not uniform, but it does not show a segmental arrangement. It is convenient, however, to refer to the part of the cord from which each pair of nerves arises as a segment, and this term can be used without implying an embryological "metameric" significance.

We will not follow the axones of the nerve-cells in their course from the ventral gray-column to their termination in the skeletal muscles, but there is one point where we may amplify the text-book description. The axones are usually considered as running horizontally through the white matter to the surface of the cord, where they make their exit and form the ventral root of the spinal nerve. In reality they run obliquely downwards as well as ventralwards, and consequently make their exit at a point lower in the cord than the location of their cell-bodies. This holds true in the upper cervical and thoracic regions. In the region of the enlargements they run more horizontally ventralwards, but turn and run caudally for some distance before leaving the cord.

Let us consider the function of these large ventral column cells. Upon them depends the health and normal activity of the voluntary muscles of the trunk and limbs. As mentioned above, if the cell-body with its nucleus is damaged beyond recovery, it cannot be replaced. If the nerve cells supplying a muscle die, that muscle suffers atrophy and loss of contractility. This atrophy is more than mere decrease in volume. The contractile substance is removed and replaced by fat. If an axone is cut or damaged, in such a way that the connection between its cell-body and the muscle-fibre it supplies is broken, degeneration of the muscle fibre follows. If this connection is regained through the process of Wallerian regeneration. the muscle fibre regains its health and contractility.

The fibres of the skeletal muscles are powerfully controlled through one source, the large nerve cells of the ventral gray column. The cells in turn receive controlling impulses from many sources. We shall discuss some of the most important connections by which this control is exercised. By the sensory cells of the dorsal root ganglia impulses are passed on through connector cells to the motor cells of the anterior horn, thus forming the simple reflex arc. The reflex activity of the muscles is dependent on this arc. These impulses arise chiefly in the skin, but other impulses arising in the muscles themselves travel also by cells in the dorsal root ganglion and finally reach the motor cells. These "proprioceptive" impulses form the fundamental basis of the normal tonic contraction of the muscles, the so-called "tone."

The labyrinth of the internal ear is connected to the motor cells of the spinal cord by the vestibulo-spinal tract of nerve fibres. By this connection the labyrinth exercises equilibratory control on the skeletal muscles.

The cerebellum is connected by fibres running in the rubrospinal tracts to the Anterior Horn cells and has a profound influence on the tone of the muscles and on the strength and co-ordination of the muscular movement of the same side of the body. This action seems to be a positive one, as its absence, due to disease of the cerebellum, leads to atonia, weakness and loss of co-ordination.

Finally, the volitional control of the muscles is known to be executed by cells of the cerebral cortex situated in the pre-rolandic area. The fibres of these cells run in the cortico-spinal (pyramidal) tracts and connect with motor cells on the opposite side of the body. They influence the tone of the muscles and the reflex mechanism, but this influence proves to be of an inhibitory nature, for when it is cut off the muscle shows hypertonicity and increased reflex activity.

We can therefore, divide the impulses acting on the anterior horn cells into two groups: Those coming through the sensory cells of the dorsal root ganglion, and secondly, those coming by descending tracts of nerve fibres from higher centres in the nervous system. We have reviewed them very simply, ignoring the fact that these impulses must act through a complicated system of connector or internuncial neurons. When we remember that many fibres must act together in the contraction of one muscle, and that no muscle acts alone, but that the normal posture and movement of the whole body, or any part of it, is dependent on the synergistic contraction and relaxation of many muscles, we are not surprised at the complexity of this system. The striking fact is that all these impulses from cerebrum, cerebellum, labyrinth and other centres converge on the anterior horn of the spinal cord, and the "final common path," as Sherrington calls it, is by means of this lower motor neuron to the muscle.

The Colloidal Gold and Related Reactions of the Cerebro-Spinal Fluid.

By E. H. BENSLEY, B.A., 3T0.

The manner of discovery of the diagnostic value of the colloidal gold test is an excellent illustration of the well-known truth that a piece of research often leads accidentally to unexpected discoveries of importance which bear no relation to the purpose for which the research was initiated. In 1901 Zsigmondi discovered that solutions of proteins protect colloidal solutions of gold and other metals from precipitation of the colloidal material by electrolytes, and that it is possible to express numerically the degree of protection afforded. In 1903 the French school, led by Ravaut, Sicard and Widal, demonstrated the occurrence of important changes in the protein content of the cerebro-spinal fluid in certain diseases of the cerebro-spinal axis and meninges. In 1913 Lange attempted to apply the results of the work of Zsigmondi to the quantitative estimation of the protein content of the cerebro-spinal fluid in health and disease, expecting that the degree of protection from precipitation offered by the fluid to a colloidal gold solution in the presence of an electrolyte, as sodium chloride, would be an index of its protein content. The result obtained was not what he had expected. When normal cerebro-spinal fluid containing only a trace of protein was used, no precipitation of the colloidal gold in its metallic form occurred. Cerebro-spinal fluid, the protein content of which was raised, actually facilitated, rather than prevented, the precipitation of the colloidal gold. When different dilutions of cerebro-spinal fluid were used it was found that the power of the fluid to precipitate colloidal gold varied with the dilution, and this variation in power with dilution was not the same in all cases.

Technique:—In order that these statements may be more clearly understood it will be necessary to describe briefly the procedure of the test and the difficulties that have arisen. A series of eleven tubes are set up in a rack. The tubes are numbered from one to eleven. In the first tube is placed 1.8 ccs. of a 0.4% solution of sodium chloride, and in each succeeding tube is put 1 cc. of this solution. To the first tube is added 0.2 ccs. of the cerebro-spinal fluid to be tested and the fluids thoroughly mixed. This first tube contains 1 part of the cerebro-spinal fluid in 10 parts of total solution. Then 1 cc. of this diluted cerebro-spinal fluid is transferred from the first tube to the second and the solutions mixed. Next 1 cc. of solution is transferred from the second to the third tube and this transference of solution from one tube to the other with thorough mixing following each transference, is continued until the tenth tube is reached, whereupon one cc. of the fluid in this tube is discarded in order that the volume of solution in each tube may be the same. No solution is transferred to the eleventh tube which therefore contains no cerebro-spinal fluid and serves as a control. If this procedure is carefully considered it will be seen that the first ten tubes now contain dilutions of spinal fluid ranging from 1 in 10 in the first tube to 1 in 5120 in the tenth tube. To each of the eleven tubes are added 5 ccs. of colloidal gold solution and the solutions mixed. The test is read after the tubes have stood at room-temperature for 12 hours. The colloidal gold solution is red in colour. If any of the gold is precipitated the colour of the fluid changes, and the colour to which it changes depends up-

on the amount of precipitation.* Thus, after the tubes have stood for the prescribed time, the colour of the fluid in each tube is an index of the amount of precipitation which has taken place, and this is expressed by numerical values assigned to the various colours as follows:

Red (unchanged, no precipitation) ..... = 0
Blue-red (more red than blue) = 1
Red-blue (more blue than red) = 2
Blue ..... = 3
Pale lavender (almost colourless) ..... = 4
Colourless (complete precipitation) ..... = 5

The solution in the control tube should be red in colour.

The readings in the series of ten tubes may be expressed in two ways. First, the readings may be written as a sequence of numbers, the first number being the reading in the first tube containing cerebro-spinal fluid in a dilution of 1 in 10, the second number the reading in the second and so on to the tenth number, which is the reading in the tenth tube containing cerebro-spinal fluid in a dilution of 1 in 5120. For instance, if there were complete precipitation in the first four tubes, the colour of the fluid in the fifth tube blue and the colour of the fluids in all the remaining tubes red, these readings would be expressed as follows — 5555300000. The second method of expressing the results is a graphic one, a graph being plotted between the numerical values of the colours of the solutions as ordinates and the numbers of the tubes as abscissae, the tubes being numbered as in the first method. For the sake of convenience the first of these two methods is adopted in this article

* The term "precipitation" is used to denote not only actual settling out of a precipitate of metallic gold as a result of a great increase in the size of the colloidal gold particles, but also minor degrees of increase in size of these colloidal particles insufficient to produce actual settling out of metallic gold. Both these processes—actual settling out of metallic gold and increase in size of particles without settling out—play a part in the prodction of the colour changes.

On account of the very great difficulty of preparing the colloidal gold solution and the precautions which must be taken in regard to the water and glassware in performing this test, tests employing colloidal solutions other than that of gold have been devised. In 1915 Emanuel introduced the gum mastic is substituted for the solution of colloidal gold. The difficulties encountered in the performance of the colloidal gold test are avoided if this test be used. The gum-mastic when precipitated in the non-colloidal state forms an easily visible white precipitate and the amount thrown down can be observed directly. Thus the method of reading the results is different from that employed in the case of the colloidal gold test, in which the amount of precipitation is determined by observing the colour of the fluid. The results of the colloidal mastic test can be recorded as a series of numbers or as a curve, as was described for the colloidal gold test. In 1920 Guillain and Lachelle introduced the colloidal benzoin test in which a colloidal solution of gum benzoin is used. This test is essentially similar to the colloidal mastic. The results obtained using these three tests—the colloidal gold colloidal mastic and colloidal benzoin—agree remarkably well.

The most important variation which is encountered in the colloidal reactions of different fluids, which produce some precipitation of the colloidal material, is the range of dilutions in which most marked precipation occurs. The series of dilutions is usually divided into three parts called "zones" which overlap. If ten tubes are being used, the first five constitute the first zone, the middle four or five the second or mid-zone and the last five the third zone. The reaction is described as a first, second or third zone reaction depending on the zone in which the precipitation is most marked. Thus 5555320000 would be a first zone reaction since the greatest precipitation occurs in the first zone. Another variation in the results

obtained using different fluids is the degree of precipitation in the zone in which the precipitation is most marked. If the maximum amount of precipitation be represented by figures less than 4 the reaction is said to be weak, and if it be represented by 4 or 5 the reaction is said to be strong. Thus, 5555-320000 is a strong first zone reaction and 3332100000 is a weak first zone reaction.

As a rule a normal cerebro-spinal fluid will produce no precipitation in any of the ten tubes, the reaction being expressed thus—0000000000. However, a slight precipitation sometimes occurs in some of the tubes, although this is never marked. Therefore a weak colloidal reaction should not be regarded as conclusive evidence of the existence of some pathological condition—especially when unassociated with any clinical or other laboratory signs of disease of the central nervous system.

Value: The colloidal tests are of greatest value in the study of cases of neurosyphilis and meningitis. The discussion of the colloidal reactions of the spinal fluid in pathological conditions of the central nervous system is divided, in this article, into three sections—(1) the reactions in neurosyphilitic conditions, (2) the reactions in the commoner meningitides and (3) the reactions in other diseases of the central nervous system.

(1) Neurosyphilis.

(a) General Paresis.

Spinal fluids from 96—98 per cent. of untreated cases of general paresis give a strong first zone reaction, e.g., 5554210000. The first zone is called the "paretic" zone. As a rule the degree of precipitation in the first tube is not exceeded by that in any succeeding tube. When the results are expressed graphically a "step-ladder" curve is obtained. Rarely a weak first zone or weak or strong second zone reaction is given by fluid from an untreated case.

(b) Non-paretic Neurosyphilis.

The non-paretic group includes diffuse cerebro-spinal syphilis, vascular neurosyphilis, tabetic neurosyphilis and gummata of meninges and cerebro-spinal axis as well as the neurosyphilis occurring in many, and perhaps all, cases of syphilis in the secondary stage. Fluids from cases of diffuse cerebro-spinal syphilis and tabetic neurosyphilis give, as a rule, a reaction which differs from the paretic reaction in two respects. First,, it is weaker and second, the greatest precipitation occurs in the mid-zone. A typical reaction is 0123332100. The mid-zone has been termed the "syphilitic" or "luetic" zone although this is a little misleading since paresis is also a form of neurosyphilis. It is also called the "tabetic" zone. This weak mid-zone reaction is not found as constantly in these forms of non-paretic neurosyphilis as is the paretic reaction in paresis. Strong first zone and weak first zone reactions are given by a very considerable percentage of fluids from cases of diffuse cerebro-spinal syphilis and tabetic-neurosyphilis. Occasionally fluids from these cases give a negative result, that is no precipitation, even when antisyphilitic treatment has not been administered. Fluids from cases of vascular and gummatous neurosyphilis and secondary syphilis may behave in a similar manner to fluids from the other types of non-paretic neurosyphilis considered, but very frequently negative results are obtained.

(2) Meningitis.

Fluids from cases of acute suppurative meningitis due to Streptococcus, Pneumococcus or Meningococcus usually give a third zone reaction which may be weak or strong e.g., 0003455510 and 0000123310. As a rule there is little or no precipitation in the tenth tube. However, fluids from these cases may give weak second zone or strong or weak first zone reactions.

Fluids from cases of tuberculous meningitis usually give a reaction which is weak, and in which the most marked precipitation tends to occur nearer the second zone than in other types of meningitis but is still as a rule,

a third zone reaction. The third zone has been termed the "meningitic" zone.

(3) Other Diseases of the Central Nervous System.

(a) Acute Anterior Poliomyelitis.

Fluids from these cases give a mid-zone reaction. Attempts have been made to use the results of the colloidal tests as a point of differentiation between tuberculous meningitis and acute anterior polymyelitis. The reactions in the two conditions are very similar but poliomyelitic fluids usually give a maximum precipitation with distinctly lower dilutions than do fluids from cases of tuberculous meningitis.

(b) Disseminated Sclerosis.

There is no one type of curve which can be said to be characteristic of fluids from these cases. In some cases a negative result is obtained; in others the reaction is of the weak mid zone type while still others give a strong first zone or paretic reaction. Some workers have laid considerable emphasis on the paretic reaction obtained in some cases of disseminated sclerosis, and I have heard it stated that a paretic colloidal reaction occurring in conjunction with a negative spinal fluid Wassermann in a case in which antisyphilitic treatment has been administered, indicates the existence of disseminated sclerosis. This is not true. Fluids from cases of brain tumor and also of purulent meningitis, having a negative fluid Wassermann, sometimes give a paretic reaction.

Colloidal reactions of various types have been reported as occurring with fluids from cases of diseases of the central nervous system besides those mentioned, but the reactions obtained are very variable and are, as yet, of no diagnostic value.

The explanation of the colloidal reactions is not known. Weston, working with paretic fluids, has shown that the Wassermann reaction bodies will not dialyze through a membrane which is freely permeable to the substance or substances responsible for the paretic colloidal gold reaction, thus demonstrating that the latter are not identical with the Wassermann reaction bodies. Weston has also proved that the inorganic salts, copper-reducing substance, albumin and peptone of the fluid are not responsible for the paretic reaction. The colloidal reaction bears no relation to the globulin content of the fluid as estimated by the Ross-Jones test. Fluids containing a marked excess of globulin may produce no precipitation of colloidal gold and fluids containing a normal trace of globulin may give a strong paretic reaction.

Conclusions: In conclusion, there are given the following rules which will serve as a guide in the interpretation of colloidal reactions. Since the explanation of these reactions is not known, these rules, as well as any statements which may be made regarding the types of reactions found in various pathological conditions, are of necessity, purely empirical.

(1) There is no one type of reaction which is pathognomonic of any one condition and the reaction is of diagnostic value only when considered in conjunction with clinical and other laboratory findings.

(2) A negative result does not exclude the possibility of existence of disease of the cerebro-spinal axis or meninges.

(3) Weak reactions usually, but not always, and strong reactions always indicate disease of the cerebro-spinal axis or meninges.

(4) 96-98 % of fluids from untreated cases of paresis give a strong first zone reaction but a similar reaction may be given by fluids from other types of cases. A strong first zone reaction is suggestive of, but not conclusive evidence for, the existence of general paresis. When an untreated case does not give a strong first zone reaction it is good evidence that the case is not general paresis

(5) Tuberculous meningitis and purulent meningitis fluids characteristically, but by no means invariably, give

third zone reactions which are, but infrequently, given by fluids from other types of cases. Syphilitic fluids never give third zone reactions.

(6) Second zone reactions are given by fluids from a variety of cases and are the least reliable of the types of reactions.

In my opinion the diagnostic value of these colloidal reactions has been greatly exaggerated by many investigators. The reactions are variable and, furthermore, in many cases a diagnosis can readily be made without the aid of the results of the colloidal tests. However, with better standardization of the reagents used and the discovery of the explanation of the reactions, it is possible that their diagnostic value will increase.

The Relation of Focal Infection to Chronic Arthritis.*

By RUSSELL L. CECIL.

Perhaps I should apologize for speaking on such a threadbare subject as focal infection, but it is a problem in which I have been very much interested for a number of years, and it seemed to me it might be worthwhile to go over some of the evidence on this still so-called theory, and see just how we stand on it at the present time.

Those who are old enough will recall that as far back as 1910 Frank Billings began to write about the importance of foci of infection in arthritis and neuritis In the same year D. J. Davis studied foci of infection bacteriologically in nephritics and arthritics. Later E. C. Rosenow produced arthritis experimentally in rabbits with streptococci isolated from foci of infection in man. In Germany, Kirschman, Koch and others called attention to the importance of tonsillectomy in arthritic patients with diseased tonsils. Barker in Baltimore was also very much interested in this subject and stressed the importance of removing infectious foci in arthritic patients.

The pominence of these men attracted a great deal of interest to this subject and it became a popular theme for discussion. When I was graduating from medical school focal infection was very much before the profession and had a great wave of enthusiasm as many of you, no doubt, remember.

In contrast to this I would like to refer to some recent history. I went over to Philadelphia about two or three months ago to a meeting of the Rheumatism Committee. At that meeting there were men from various parts of the country—students of arthritis and several orthopedic surgeons. One of the subjects that came up for discussion was the terminology of chronic arthritis and I argued for calling it, as many people do now-a-days, chronic infectious arthritis instead of rheumatoid arthritis or atrophic arthritis. But to my surprise I found a strong sentiment against this term in this committee of eight or ten gentlemen. They said, "How do you know that it is infectious?"

That was a question that rather stunned me. I thought that every one had assumed it to be infectious. I was actually voted down in this committee meeting on calling the chronic arthritis with swelling and deformity chronic infectious arthritis. They voted to call it chronic atrophic arthritis.

Why has this reaction come about? There is undoubtedly a large element in the profession to-day who look askance at focal infection. I will venture to say a good many of these men are orthopedic surgeons and men who see arthritic patients late in the disease.

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* Read before the New York Academy of Medicine, May 17, 1928. Published in the Academy's Bulletin of September, 1928.

Now it is a fact that the removal of foci of infection late in arthritic infection has very little influence on the disease, that is, in most cases. It is only when foci are removed early that we get satisfactory results.

Another reason for the reaction against focal infection is the failure to classify our cases. The students of arthritis are pretty well agreed that all cases of chronic arthritis should be divided into two main groups, the infectious migratory type with swelling of the joints which occurs mostly in younger people, and the degenerative arthritis that comes late in life and is characterized by bony and cartilaginous changes.

We have been very much interested in this classification of arthritis at the Cornell Clinic and we are convinced that the second type which occurs in old age is non-infectious and is not dependent in any way on focal infection. This, of course, is a hard thing to prove. In studying these cases of degenerative arthritis—old ladies with creaky knees who are usually overweight—the lesions appear to result from the strain and wearing out of the joint from trauma or too much weight. This type of arthritis is not associated, as a rule, with foci of infection. These old women of fifty-five or sixty have usually lost most of their teeth, any way, and the tonsils are small and atrophied and show no signs of infection.

Undoubtedly, there has been, in the past, too much pulling of teeth and removal of tonsils in this type of arthritis. Patients and physicians have been disappointed, and that, no doubt, has accounted for some of the reaction against focal infection.

In the infectious type of arthritis, on the other hand, we usually do find foci and if these are removed early the patient is generally benefited by the operation.

Let us now discuss briefly the location of foci. Of course, the commonest is in the tonsils or the teeth. Third should come sinuses. Then we have the bronchi, genital tract, gastro-intestinal tract, urinary tract, etc. In our studies at the clinic we have found the tonsils to be by far the commonest focus of infection, thus agreeing with most other people who have worked along this line. We have estimated sixty-five to seventy per cent. of our cases of arthritis are associated with diseased tonsils. Next in frequency are the teeth with apical abscesses, twenty-five to thirty per cent. That leaves a comparatively small number of cases that are caused by the other foci, such as sinuses, gall bladder, etc. The gall bladder, by the way, is not an unusual focus. We have seen several cases where chronic cholecystitis existed, and with the flare-ups of acute symptoms in the gall bladder, there immediately appeared symptoms in the joints. As the gall bladder quieted down the joints also subsided.

Twenty years ago Billings said he had found very few cases of chronic arthritis associated with intestinal infection. That has been our experience. We should say, however, that with chronic ulcerative colitis, arthritis could be associated with probably some etiological connection.

It is interesting to note that in our analysis of 200 cases of infectious arthritis, the patients with infected tonsils were decidedly younger than those with infected teeth. That, of course, was to be expected, because tonsilitis is a disease of young people, whereas root abscesses occur in later life when teeth begin to deteriorate.

What constitutes a diseased tonsil? A tonsil, of course, with pus in it, as opposed to a tonsil with only cheesy material in it. I am always suspicious of a large tonsil. I am suspicious of a small, red, congested tonsil, associated with redness and congestion of the anterior and posterior pillars.

What constitutes a diseased tooth? That is a still more difficult problem. Rosenow teaches that every dead tooth

is a menace and actually harbors streptococci in the canal, and he advocates the extraction of all dead teeth (regardless of X-ray findings) in patients with chronic arthritis. It seems to me that this is a radical position and one very few of us would care to take. We all carry around devitalized teeth and would not like to part with them, even if we have occasional arthritic pains. These teeth should not be disturbed unless the X-ray shows some definite signs of periapical infection. Furthermore, we must not expect to find pus in these abscesses always. Many of them show only granulation tissue.

But what is the real evidence for this focal infection theory? We still must call it a theory, for it has not been absolutely proved. What is the evidence to support this theory? The first is, I should say, by analogy. We have the most perfect type of focal infection in gonorrhea, when an acute or sub-acute gonorrheal infection in the prostate and seminal vessels is followed by an arthritis and gonococci are found in these joints. This is the prototype of focal infection, a local infection with metastatic infection in the joints. If this happens in gonococcus infections, there is no reason why it could not happen in infected tonsils or infected teeth of streptococcal origin.

Perhaps a stronger argument still for the focal infection theory is just from experience. Those who have worked a great deal with arthritis have seen so many patients relieved by the prompt and early removal of foci, that it is impossible not to believe that some actual etiological connection exists between the focus and the infected joint.

I am not going to tire you with a lot of case reports, but I want to cite three or four typical cases. For instance, here was a little girl three years old with chronic infectious arthritis, sometimes called Still's disease. Her case was not advanced. For six months she had had swelling of the knees, ankles and wrists. The fingers and the knees were held slightly flexed. A very bad prognosis had been given the mother by a prominent pediatrician in this city. The little girl showed tonsils that did not look particularly bad nor particularly good. The laryngologist that saw them advised tonsillectomy. We agreed, and she made a complete recovery in nine months. In nine months from being an invalid and unable to walk she was completely cured, and had no residual stiffness or deformity in any of these joints.

There are several cases where the focal infection was very obscure and where some difficulty was found in locating it. A spinster, aged forty, with chronic arthritis, duration two years, had symptoms in the knees, back, shoulders, later in the hands and feet. There never was a great deal of swelling. She had had tonsillectomy one year after onset. The teeth were negative. A hysterectomy for fibroids was performed three years ago, one year before the onset of arthritis.

Examination showed a pin-hole hymen which when opened revealed a large retention of pus. This being drained, the patient made a complete recovery. Evidently the vaginal infection was subsequent to the hysterectomy, causing a chronic sluggish infection there in the vagina.

Trained nurse, aged twenty-nine. Tonsils out six years ago. Teeth negative. One and a half years ago onset. One year ago several fingers began to swell. At the time of the first examination knees, fingers and left foot were swollen. No evidence of any infection around the nose or throat. This patient was quite a problem. She did not respond to any of the usual forms of treatment. She had some symptoms of appendicitis. We took the appendix out, with no help. She came in a year later with redness in one eye and some obscuring of vision. She was found to have iritis. She was referred to a laryngologist who discovered a sphenoidal sinusitis. It was drained and

eighteen months later she was back on duty.

The third case was also a spinster, aged forty-two. Tonsils out six years ago. One dead tooth. X-rays of teeth negative. Six months ago she had a uterine polyp removed. Two weeks after the operation she developed a polyarthritis with swelling. Physical examination showed swelling of the ankles and knuckles, elbows tender. The uterus was suspected, but the gynecological report was negative. Six months later the patient reported some vaginal discharge. She was again sent to a gynecologist and this time he reported purulent infection of Bartholin's gland. The gland was dissected out and she made a rapid recovery.

Here is a final case. A man, aged forty a salesman, chronic polyarthritis with swelling for six months. After treatment in a neighboring city for several months without success, he came to New York where pus was found in the urine. Cytoscopic examination showed pus coming out of the right ureter. To make a long story short, gravel and pus were found in the discharge. The right kidney was removed and the patient made a complete and uneventful recovery and went back to his business.

These are rather unusual foci and indicate that the discovery of the focus is not always easy. Very often the tonsils have been removed before any arthritis is felt. In other cases the removal of the tonsils gives the patient no relief. So we have to make very careful and exhaustive searches for the concealed foci.

Now, as to the bacteriology of these foci of infection. Davis in his early studies rather leaned toward the streptococcus hemolyticus. As you know, various organisms are found in the tonsils; indeed, several type of streptococcus. We have the green streptococcus, the indifferent streptococcus (streptococcus that produces neither green nor hemolysis), and the hemolytic streptococcus.

The early workers felt the hemolytic streptococcus was responsible for the joint changes. It seemed to be the most virulent, and it readily produced arthritis in rabbits, but one could also produce arthritis with the green streptococcus, and the green streptococcus produced an arthritis more like that in patients. The hemolytic streptococcus experimentally injected in animals usually produces a suppurating type of arthritis.

What other organisms can produce this infectious form of arthritis we are not prepared to say, but certainly the burden of evidence goes to show that the streptococcus is responsible for most of them.

But are the joints in chronic infectious arthritis actually infectious, or are they simply toxic phenomena? Some may have heard Dr. Swift's paper in Washington two weeks ago when he suggested that the joint manifestations in rheumatic fever might be allergic in character. These patients are extremely sensitive to streptococcus protein, and when the protein is injected intravenously they have a reaction very much like a positive tuberculin reaction It may be that the joint manifestations are due to hypersensitiveness to the streptococcus protein. This is a point which has not yet been cleared up.

During the past year we have been finding some rather interesting things in our chronic arthritis at Bellevue and in the Cornell Clinic. We have been taking blood cultures on these cases and we found to our surprise that by using a certain technique, green streptococci could be isolated in quite a large number of cases right from the blood. This is done by taking cultures from the blood clot. Another feature of the technique is not opening the cultures for ten days to two weeks after inoculation. They are allowed to incubate without disturbance for at least ten days.

Suffice to say, that by using this technique green streptococci can be recovered in seventy-five to eighty per cent. of all cases of chronic infectious arthritis with swelling or actual deformity of the joints. They are not present in controls; they are not present in other types of arthritis. We have studied forty-five cases of chronic arthritis of the infectious type and about fifty controls, and so far we have had negative results in all control cases.

We have also cultured the joints themselves in six cases of chronic infectious arthritis, not simply by puncture but by taking actual material from the joint. These joint cultures are rather interesting. In two of the joints we were able to get curettings of bones and cartilage. They were cases which for some reason or other had come to orthopedic surgery for correction. Two of these cultures then were from bone curettings and the other four were from synovial membrane. The four cultures from synovial membranes were sterile but the two from the bone curettings gave green streptococci. Both of these patients in whom green streptococci were found in the hip joints had green streptococci also in the circulating blood.

There are several possible explanations of these findings. In the first place we must naturally ask if they are contaminations. The streptococcus is an unusual contamination. Most laboratories find staphylococci, hay bacilli and diptheroids the commonest form of contamination. We don't expect to get the green streptococcus as a contamination. Another point against their being contaminations is that they were not found in the control cases. They were not found in quite a large series of non-arthritics and healthy individuals. Then, these streptococci when injected in rabbits in small doses produced a very beautiful non-suppurative arthritis. We have not followed it long enough to say whether or not it will end in deformity. Certainly when these streptococci are injected introvenously they very soon set up a non-suppurative, proliferative arthritis in rabbits.

Another explanation would be that they are in the blood but have no significance. Streptococci undoubtedly do get into the blood from time to time. They have been reported in measles, and probably in acute tonsilitis. It is conceivable that they might be circulating in the blood in chronic arthritis, but had no connection with the disease. However, it would seem very strange to have in the blood bacteria capable of producing arthritis if they did not have some etiological relationship to the joint lesions.

Another explanation would be that they were related indirectly to the joints. That is, the joints might be allergic lesions but not actual infections.

Finally we might assume that the green streptococci came from some focus of infection and were actually responsible for the joint lesions. That seems to me the most probable and the simplest explanation of the picture.

Of course, we are wondering where these streptococci emanate from. Most of the patients had the tonsils removed at the time blood cultures were taken. Where do these streptococci come from? Do they come from the nasopharynx or the intestine? Are they located in the lymph glands or in the spleen? They come out irregularly. In some of the patients we have taken repeated blood cultures. Sometimes they are positive and sometimes negative. They are not there all the time. I presume this might explain the flare-ups which these patients have, feeling comfortable one week and very uncomfortable the next.

Rosenow, twenty years ago, isolated green streptococci from the lymph glands in cases of chronic infectious arthritis, and recently this work has been verified at Johns Hopkins by Baehr and his co-workers.

Now, just a word in regard to the

treatment of foci of infection. I have already mentioned the time factor. I don't think it has been sufficiently stressed in the past. There has been too much of a feeling that all that had to be done in chronic arthritis was to take the focus out and the patient will get well. It all depends when these things are done. It certainly is a great mistake to allow foci of infection to stay in with the idea that the patient under hygienic measures and drugs or vaccines is going to get well with the focus still in his body. The fact is, he may get better, or well; but he is going to have recurrences. One of the characteristic features of this disease is its tendency to recur. As long as the focus remains, this tendency will manifest itself. We found in a large number of cases that in patients who were cleaned up during the first year a very high percentage got well, whereas, in those who came in after four or five years of arthritis and were then cleaned up, the removal of foci had no effect at all on the course of the disease.

One of the questions most often debated is whether apparently normal tonsils should ever be removed. I think the answer is, under certain circumstances, yes The very frequency with which chronic tonsillitis and chronic arthritis are associated justifies their removal if, after careful search, no other focus can be found.

As I said before, the teeth should be carefully gone over and abscessed teeth removed; but beware of too much radical treatment of teeth in elderly people who have degenerative osteoarthritis, because in such cases, pulling teeth is rarely going to do good. If a number of teeth are to be extracted, it is better to remove one or two at a time than to take them all out at one sitting. It has been found from experience that extraction of five or six teeth at once is apt to bring on acute exacerbation of symptoms. The sinuses have to be studied very carefully, especially the ethmoids and sphenoids. It is very easy to overlook infection in this particular location. After the removal of foci, of course, we resort to various measures, drugs, physiotherapy and vaccines, preferably autogenous. Of course, we are trying out vaccines made from these bloodstream streptococci. Some patients are extremely sensitive to them and the dosage has to be small in the beginning.

Osgood believes in a vitamin diet for the arthritic. He gives them fresh vegetables, fresh fruit, cod liver oil, etc. He argues that in chronic arthritis there is a depletion of calcium in the bone leading to the characteristic atrophic changes in the bone, and he reasons that by using a high vitamin diet and sunlight on these patients, the calcium can be driven back into the bone, with presumably a great deal of benefit to the patient. Osgood does not use vaccines, but depends almost entirely on hygienic and orthopedic measures. Rest, fresh air and sunlight are most important, and particularly rest. Pemberton stresses rest very much in all of his writings.

I think the climate is a big factor, one unfortunately that we can't resort to as much as we would like. Patients who can afford it may be sent out to Arizona, where there are a number of sanitaria at the present time, and in that dry, hot climate they make recovery much more rapidly than in a moist climate. Unfortunately Arizona is a long way off, and very few patients can afford to make such a trip. If they must stay in a damp climate it is probably better to get them into the mountains, where there is less humidity and where they can get the benefit of a high, dry atmosphere.

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EDITORIAL.

H. R. Ziegler. The appointment from our Faculty of H. R. Ziegler, 2T9, as one of the two Rhodes Scholars from Ontario, came as one of the most pleasant surprises of the year. "Zieg." is one of the most popular and brilliant scholars in our midst, and well deserves the award. The success of his past efforts predicts a future not attained by many. The members of the Faculty will unite with us in wishing "Zieg" God speed.

F.R.C.S. EXAMINATIONS.

The Primary Fellowship Examination of the Royal College of Surgeons, England, will be held in Canada next July. In addition to graduates, those students who have completed the third or higher years of their medical course are eligible to try this examination. A review course in Anatomy is being started immediately to help prepare candidates, and all those interested are requested to send in their names, addresses and telephone numbers to Dr. James C. Watt, Department of Anatomy, University of Toronto. Do not delay if you desire to become a member of this course, which will include Gross Anatomy, Histology and Embryology, with various members of the staff participating.

Inquiries should be made at the office of the Secretary of the Canadian Medical Association, 184 College Street,

Toronto 2, for particulars as to the examination.

The Pre-Clinical Years. The protests and fireside "talk fests" on the teachings and subjects of the preclinical years has come to be a part of medical students' lives. Be it here or elsewhere these rumblings are all essentially the same. That the curricula of the various medical schools is by no means absolutely perfect is well shown by the reports of the Commission on Medical Education of the A.M.A. As a matter of interest our University President, Sir Robert Falconer, is a member of the committee.

Somewhere there is an adage that "patience will wear away stone," and if the members of these fireside sessions would but realize that the best academic minds of the world are as much interested in this problem as anyone they might shoulder what seems to them to be their burden, and do as others have done in the past—learn their work as they go along, and be prepared for the practical application of this knowledge in the exceedingly interesting clinical years that loom up over the horizon before they realize it.

The Journal. Our request for criticism has as yet not brought forth the quantity of advice that was expected. One suggestion that the sudents prepare case reports on interesting or unusual cases on the wards is especially the sort of thing we desire. We sincerely hope that the students of the upper three years will follow this lead. That their clinicians and our staff will aid them goes, we hope, without saying.

This month we offer a paper on Chronic Tuberculous Infections of the Lungs, by Professor Holman, that clearly shows us that we must not be too ready to attribute every case of chronic lung diesease to tuberculosis. It is the sort of good sound advice we students need. Fred Harvie presents a paper on the physiology of the thyroid that we can all well afford to read. Anatomy and physiology are essential to the understanding of any clinical problem. The paper is well handled. Dr. J. A. Oille on Systolic Murmurs offers the type of article the staff of the Journal value. It is written in the clear and concise style characteristic of Dr. Oille. The Motor-Cells of the Spinal Cord by Miss Craw is of special interest to the lower years. Miss Craw has done considerable research in anatomy and is a well qualified writer on her subject. Professor Harding's article on Factors in Vomiting of Pregnancy presents a brief review from one who is well acquainted with his subject. The importance of a knowledge of the toxemias of pregnancy is essential to all students. E. H. Bensley's article on the Colloidal Gold Reaction discusses, explains and interprets a difficult laboratory procedure in a very admirable manner. Its interest is probably a trifle academic, yet it is a test we all must be familiar with. The paper by Dr. Russell L. Cecil on Focal Infection in Chronic Arthritis the Journal Staff believes is an expression of opinion by an authority on a subject which at present is by no means settled. The case reports given clearly indicate that the more obvious foci are not always at fault.

Miss Grant presents a historical article on the death and autopsy of Napoleon. This is of great interest, and leads one back to one of the most powerful characters in history on a new route. The mental picture of mortal men delving into the mysteries of this striking character's death holds ones attention throughout. "Pete" McGarry's article on Medical Athletics and Athletes is well handled. It is a complete review up to January, 1, 1929.

Again, may we call your attention to what we believe is an obligation to yourself. That is to consult one of the Journal staff in regard to preparing an article.

Alpha Omega Alpha. The annual banquet of the Alpha Omega Alpha Honour Medical Fraternity was held on November 23 at the Prince George Hotel. The speaker of the evening was Prof. J. C. McLennan, head of the Department of Physics, who delivered an address full of interest, especially to those interested in the application of the newer discoveries in Physics to the practice of medicine and medical research.

The following new members were iniated into the fraternity:

Honorary Member—Dr. W. L. Robinson.

From the 6th Year—J. E. Gundy, F. M. Greig, G. H. Hames, R. M. McKeown, C. B. Weld.

From the 5th Year—E. H. Bensley, J. F. Curtis, J. H. Forrester, W. A. Hawk, F. G. Kergin.

Senior Medical at Home: Of interest to the majority of students is the decision of the Medical Society to, this year, hold its premier social function in Hart House on Friday, February the first.

For years the attendance at this function has been gradually declining until it has finally not been in the least representative of the undergraduate body. The majority of the delinquents no doubt did not attend because of the high cost of tickets, which factor could not be avoided if the At Home were to be held outside the University. To reduce the cost of the tickets and at the same time not reduce the high standard of this function, so that more of the student body will attend, has been the object of the committee.

The committee, composed of the presidents of the various classes, is working hard to make this year's At Home a success, and it is to be hoped that the student body will take advantage of the lower cost of the tickets and lend their support.

Daffydil: The Daffydil Committee, under the able chairmanship of G. H. Hutton, of fifth year, is this year attempting to rejuvenate and bring to its former high standard, this oldest of medical social functions.

Believing that the show would be vastly improved, they have made the official announcement that the performance will be staged in Hart House Theatre on February 21st and 22nd. The various years have even at this early date prepared the substance of their skits and every effort is being made to raise the quality of the skits offered by every year.

We have no doubt that the student body will approve of the change of location and will support the ticket sale. All that remains to assure the success of this year's Daffydil is that each year lend a helping hand to make their skit the best yet.

Open Meetings: The last open meeting of the Medical Society was most ably addressed by Dr. Harvey Agnew, Assistant Secretary of the Canadian Medical Association and a former President of the Medical Society.

His subject, "After Graduation — What Next?" was most ably handled, and his address was listened to by an enthusiastic and receptive audience which filled the lecture room. The speaker dwelt at great length on the vital question of interneship and his advice to the students of this branch of post-graduate work was extremely valuable.

The Medical Society is making an attempt to hold these meetings at the most convenient hour for the majority of students. With this in view, any suggestions constructive or destructive will be welcomed by J. R. Lind of fifth year, the chairman of the committee.

The Yale Journal of Biology and Medicine: We have recently received the first number of the above journal. It is, we believe, the second Student Medical Journal on our continent. In general the purpose and plan is similar to our own, although the arrangement

is different. We gladly welcome the Yale Journal and hope that through the exchange of articles and ideas we may both profit.

Back Numbers: We have many requests for back numbers, especially of volume one. Volume one is in many respects the best yet issued and contains much of value to the students. Unfortunately it is almost entirely sold out, however, it is the intention of the managing editor to republish the complete volume bound and indexed for three dollars if sufficient interest is shown. If those desiring this will sign their names and leave a deposit of one dollar and fifty cents with the lists, Miss Jones in the secretary's office, and Mr. Murray in the T.G.H. Cloak Room have, we can readily determine the demand. Separate copies for all years may be had at the regular back number price of forty cents through the year representatives. Make out your list and hand it signed to him. Apparently many subscribers last year did not get the May, 1928, number. We will be glad to give you your copy should you not have it.

Napoleon — His Medical History and Post-mortem.

By MARY H. GRANT, 3T0.

Napoleon had very little faith in doctors, and none in pure physicians. He mistrusted the disinterestedness of the profession as a whole. In Egypt he said to Larrey who was arguing with Desgenettes as to the contagiousness of the plague: "You are all the same, you doctors, with your infernal principles and opinions—rather than sacrifice one of them you would let the whole army perish." He thought surgery was more exact than medicine, but expressed a complete contempt for drugs, and usually refused to take them himself. He always had great faith in hydrotherapy and counter-irritation, and a life-long passion for hot baths. Bourrieuve frequently read despatches and journals to a partially submerged royalty. Napoleon positively cooked himself by raising the temperature of the water as high as possible, and by remaining in his bath for two hours.

To the medical objectors he replied that he had always found it of the greatest service for dysuria, and also for his inveterate constipation. He also recognized the therapeutic virtues of leeches by applying them to the Royal piles which became troublesome in 1807.

From 1806 onwards his health declined. It was noticed that his face was becoming puffy and the eyes less brilliant. He began to put on flesh, his movements became slower, his speech a little hesitating and his outbursts of temper less frequent. These changes were no doubt partly due to premature senility in a man who was constantly taxing the whole of his physical and mental resources, and to endocrine disturbances.

During the one hundred days that followed the return from Elba, the Emperor's deterioration was obvious to all. He had periods of drowsiness and sometimes slept for fifteen hours on end.

After losing the Battle of Waterloo, Napoleon spent the remainder of his life in St. Helena. Barry O'Meara was his first medical attendant, and when Napoleon began to complain of a dull pain, heaviness, and a sensation of heat in the right hypochondrium, O'Meara diagnosed hepatitis. This was an unfortunate diagnosis for him to make, since it indicated an unhealthy climate, and it was the contention of the British that St. Helena was a sort of earthly paradise where one should live

forever. Because of his diagnosis, and also because of intrigues with the French, O'Meara was put under arrest, and expelled from St. Helena in July, 1818.

After the departure of O'Meara, and before the arrival of Antonmarchi, Napoleon had no special medical attention. On January 17, 1819, he had an attack of vertigo. Dr. John Stokoe was called in and confirmed the diagnosis of hepalitis. On account of this diagnosis, but ostensibly because he broke certain regulations, Stokoe, like O'Meara was sent home, and dismissed from the service.

Antonmarchi arrived in September, 1819. He was a young Corsican physician, anatomist and pathologist. Napoleon used to suffer from severe pains in his stomach; he would clasp himself groan, "O, mon pylore." By this time he was suffering from cancer of the stomach, though Antonmarchi did not suspect it, but like O'Meara and Stokoe diagnosed hepatitis. When Napoleon groaned, and writhed in agony, it is said that Antonmarchi merely laughed and prescribed tartar emetic in lemonade. Napoleon was violently sick, and thought himself poisoned. He swore he would never again taste any of Antonmarchi's medicine. Another fault that Napoleon found with the unhappy young man was that whenever he wanted medical attendance, Antonmarchi was not to be found, but had to be ferreted out from Jamestown three and a half miles away, so altogether Antonmarchi's attendance could not be called a success.

As 1821 came in, Napoleon became progressively worse, and on March 25, Dr. Arnott was called in. He was the senior M.D. and a consistent upholder of the official views. He assured the Governor that there was nothing much the matter, and eight days before the patient became moribund, announced that there was no danger, and that the patient was suffering from hypochondriasis. On April 13 and 14 the dying man made his will and on the 16th became partly comatose. On April 27, coffee-ground vomitus appeared, tarry stools. On May 2 incontinence set in and risus sardonicus appeared, and Napoleon Bonaparte died at 11 minutes to 6 in the evening of May 8, 1821, aged 51 years and 9 months.

The autopsy, which was carried out next morning, must have been approached with very different feelings by the medical men present; the French and Antonmarchi hoping to find pus in the liver, and the British doctors determined to find something else, and poor old Arnott facing the music, and his diagnosis of hyphocondriasis. All agreed that the cause of death was cancer of the lesser curvature of the stomach, which was an enormous surprise to all present except perhaps the corpse who had previously suspected its existence and suggested the diagnosis. Strangely enough the body appeared quite fat, on incision, being about one inch thick on the sternum, and one and one-half inches on the abdomen, and the heart and omentum were also adipose. The abdomen was greatly distended, and on incision the peritoneum was found covered with a viscous fluid. On the anterior surface of the stomach at the lesser curvature near the pylorus was a complete perforation. The opening was completely covered with adhesions On opening the stomach it was found filled with a large quantity of "coffee-ground" material of an acid putrefying odor. The internal surface of the stomach was almost completely covered by a carcinomatous mass. Only a small part of the cardiac extremity seemed free of the disease. Antonmarchi alone mentions malignant glands in the small omentum and also describes small spots and patches of a reddish colour disseminated on the peritoneal surface of the small gut. Antonmarchi and Scott, one of the English physicians, stated the liver was enlarged and fixed by adhesions. This enlargement was denied by the other doctors who admittted the fact of the adhesions, but stated they were clearly

due to a perihepatitis which had followed an old perforation of the cancerous ulcer.

Controversy now centres around the secondary cause of death, if any.

It is said that Antonmarchi, taking advantage of a moment when the eyes of the British were not fixed on the body, took two small pieces of tissue. It is supposed that he would show this to O'Meara whom he met in London in August 1821, and that they submitted the specimen to Sir Astley Cooper, the leading pathologist and surgeon of his day. That nothing further was heard about the specimen was probably due to the fact that there was an official edict against pathological pilfering. When the College of Physicians and Surgeons received Sir Astley Cooper's pathological collection there were two small pieces of gut labelled "Incipient fungus in glands of the intestine — Barry O'Meara to Sir Astley Cooper."

Sir James Paget describes them as cancer.

Frederich Eve in 1910 cut a section and found no evidence of malignancy.

Keith and Shattock in 1913 made another section and described glandular hyperplasia and infection that might fit in with some forms of tropical disease.

Leishmann informed Keith that Napoleon's symptoms — recurrent febrile attacks, bleeding at the gums, and glandular hyperplasia would agree with Malta fever, so it is possible that O'Meara, Stokoe and Antonmarchi were right after all.

Medical School Athletics and Athletes.

By H. H. McGARRY, 3T0.

This year meds. have been well represented in fall sports, particularly in track, field and rugby.

"Mo" Mitchell Meds. VI has, as in previous years, shone in track meets. He has shown himself to be of the first water both in sprints and distance runs. Mo is also a crack basketball player. He will be a hard man to check in this latter sport.

George Sparrow Meds. IV has been very outstanding in the high hurdles. In fact he is one of the best men in this event. We also expect big things from George in interfaculty hockey this coming season.

Hal Williams Meds. II is an excellent distance runner. He hails from Hamilton. This probably accounts for his ability as a runner.

"Specks" McClelland is also a marathon runner. This fall he distinguished himself on the harriers team.

Two boys worthy of mention here are Bill Young and Gord. Hutton, Meds. IV. Gord. and Bill have trained all fall both at the stadium and over the harriers course. Both made a creditable showing this year.

"Tiny" Long, Meds. IV and Joe Kelly, Meds. V., played well for Varsity Intercollegiate Rugby team. Joe was greatly hampered this year by an injured knee, but in spite of this gave a good account of himself. "Tiny" was a power to the line and stopped many bucks through his section.

Meds. were very well represented on the Orphans "diehard team." Although vanquished by the terrible Hamilton Tigers, they are worthy of high esteem. Their victories over Balmy Beach, the powerful Dominion champions of last year, and Sarnia O.R.F.U. finalists, stamped them as worthy foemen for any team. Their exhibition of fight in Hamilton for the Eastern Senior Rugby Championship won for them not a victory, but admiration even by the Hamilton supporters. Charlie Baillie, Meds. III was captain of the Orphans this.

Unfortunately he had his knee injured in the Balmy Beach game and his spectacular playing was greatly missed for the rest of the season. Jack Sinclair, realizing the excellent opportunities in medicine, entered first year. Without a doubt Jack is the best kicking half in Canadian football. His spiral kicks in Hamilton were a treat to watch. His running at times almost equaled that of the "Galloping Ghost." Doug. Macfadyen, Meds. IV., took a year off and did research work in Bichemistry. He returned this year to thrill the football fans by his speedy and tricky running as half for the Orphans. Doug is as hard as nails, and even the heavy tacklers of the Tigers failed to knock him down for the count. His catching this year has bordered well nigh on to the sensational. Murray Scott, Meds. V, has played a whale of a game all through the season for the Orphans. He is the third heaviest man on the team, and is a tower of strength at all times. Bob Galloway, Med. II, played inside for the Orphans. Bod demonstrated this year that he knows his football. Frank Scott, Meds. III, has been subbing at outside. Whenever he played Frank always gave a good account of himself. Right here let's give three cheers for the Orphans — Ray! Ray! Ray!

In the race for the Mulock Cup, Jr. Meds. came within an ace of capturing the coveted silverware. Saint Michael's College were a little too strong for the Meds. team and eliminated the embryo docs. in the first round of the playoffs. Bill Murray with Bob Graham as his running partner, formed a nice backfield for Jr. Meds. They both accounted for many yards on running back the ball. Massig, middle wing, was outstanding for his line plunging. Ken McLeod turned in a good game throughout the season. Unfortunately he was injured toward the end of the season and was kept out of the finals. His team missed his punch and clever playing.

Senior Meds. Rugby team looked well at the first of the year, but Senior School were successful in nosing them out for the group championship, and the right to play off with Trinity in the second round. Every man on the team played well, particularly "Terk" Robinson. His line plunging was above par. He is a seasoned player and knows Rugby from A to Z. We are expecting to see Terk in Interfaculty hockey this year. He is a flash on skates and handles a wicked stick. "Good old Terk." Art Doyle played well this year and showed himself to be a tackler of the first order. "Bas" Layton was right there when it came to booting the long punts. Fred. Cuddy showed the good old fight throughout the whole season. He plays a very steady, heady game.

An account of the Meds. Soccer team will be given in the next issue of the Medical Journal. Sufficient information is lacking at the present time of writing.

Both the Senior and Junior Water Polo teams were eliminated in their respective groups this year. They had plenty of good material this year and will be heard from in the near future.

In conclusion, Meds. come out and support your hockey teams in the Interfaculty series. Deserving support has been conspicuous by its absence in the last two or three years. This year Senior Meds. have a royal opportunity to win the Jennings Cup with such stars as Sparrow, Aberhart, Williams, Bennett, Robinson, Layton, McRae, McIntyre, Perras, O'Connor and others. Let's go, Meds., and give a loud, hearty Epistaxis.

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In Memoriam

The Faculty of Medicine sustained another serious loss on Sunday, January 13th, 1929, in the death of Dr. Oliver Raymond Mabee, following a short illness.

Dr. Mabee was born at Vittoria, Ontario, in the year 1880. He received his preliminary education at Simcoe High School and proceeded to Toronto, where he obtained his degree of Bachelor of Pharmacy in 1900. He then turned to the study of medicine, graduating from McGill University in 1906 as a Gold Medalist. The following year he interned as a house surgeon at the Boston City Hospital, where his worth was soon recognized, and after one year's service he became Assistant Pathologist in that institution. He returned to Canada in 1908 and settled in Toronto, where he became associated with the Toronto General Hospital. Here he was appointed Assistant Pathologist, a post which he held from 1908 to 1919. In addition he held the position of Demonstrator in Surgery and Clinical Surgery from 1914 up to the time of his death.

During the war Dr. Mabee rendered valuable service as visiting surgeon to the Military Convalescent Homes. In the last year of the war he was attached to the Canadian General Hospital at Orpington, Kent.

During his long connection with the medical faculty of this university he was held in high regard both by the students and his colleagues in the profession. As a clinician he was always willing to help the student in his difficulties and his ready understanding, congenial manner, and subtle humour endeared him to all with whom he came in contact. We wish to express our deep sympathy to his widow and family in their bereavement.